CLAIMS

I claim:

1. A turbine vane, comprising:

a generally elongated hollow airfoil having a leading edge, a trailing edge, a pressure side, a suction side, a first end adapted to be coupled to a shroud assembly, and a second end opposite the first end adapted to be coupled to a manifold assembly;

a convergent flow channel having an inlet generally at the first end of the generally elongated hollow airfoil and extending toward the second end of the generally elongated hollow airfoil; wherein the convergent flow channel has a first cross-sectional area proximate to the first end of the generally elongated hollow airfoil that is larger than a second cross-sectional area of the convergent flow channel closer to the second end of the generally elongated hollow airfoil than a location of the first cross-sectional area;

a plurality of impingement channels extending from the convergent flow channel toward the leading edge and terminating in a leading edge cavity aft of an inner surface of the leading edge; and

wherein the plurality of impingement channels vary in length such that a first channel located closest to the first end of the generally elongated hollow airfoil is shorter than a second channel closest to the second end of the generally elongated hollow airfoil.

2. The turbine vane of claim 1, wherein the plurality of impingement channels each terminate at a substantially equal distance from an inner surface of the leading edge of the generally elongated hollow airfoil.

3. The turbine vane of claim 1, wherein each impingement channel is longer than an adjacent impingement channel positioned closer to the first end of the generally elongated hollow vane.

4. The turbine vane of claim 1, wherein at least a portion of the plurality of impingement channels have different cross-sectional areas.

5. The turbine vane of claim 1, wherein each of the plurality of impingement channels have substantially equal cross-sectional areas.

6. The turbine vane of claim 1, wherein distances between adjacent impingement channels vary.

7. The turbine vane of claim 1, wherein distances between adjacent impingement channels are substantially equal.

8. The turbine vane of claim 1, further comprising a plurality of pin fins coupled to at least one of the impingement channels and positioning the impingement channel inside the generally elongated hollow airfoil.

9. The turbine vane of claim 8, wherein each of the plurality of impingement channels has at least one pin fin extending between an inner surface of the suction side of the generally elongated hollow airfoil and attaching to an impingement channel and has at least one pin fin extending between an inner surface of the pressure side of the generally elongated hollow airfoil and attaching to the impingement channel.

10. The turbine vane of claim 1, wherein the convergent flow channel further comprises a first outflow section and a second inflow section forming a serpentine cooling path comprising at least a three pass cooling path, wherein a plurality of exhaust orifices are located in the trailing edge in communication with the serpentine cooling path.

11. The turbine vane of claim 1, further comprising a plurality of trip strips in the serpentine cooling path.

12. The turbine vane of claim 1, wherein the leading edge cavity is a divergent leading edge cavity.

13. A turbine vane, comprising:

a generally elongated hollow airfoil having a leading edge, a trailing edge, a pressure side, a suction side, a first end adapted to be coupled to a shroud assembly, and a second end opposite the first end adapted to be coupled to a manifold assembly;

a serpentine cooling path formed from a convergent flow channel forming a first inflow section, a first outflow section, and a second inflow section having a plurality of exhaust orifices in the trailing edge, the convergent flow channel having an inlet generally at the first end of the generally elongated hollow airfoil and extending toward the second end of the generally elongated hollow airfoil, wherein the convergent flow channel has a first cross-sectional area proximate to the first end of the generally elongated hollow airfoil that is larger than a second cross-sectional area of the convergent flow channel closer to the second end of the generally elongated hollow airfoil than a location of the first cross-sectional area;

a plurality of impingement channels extending from the convergent flow channel toward the leading edge and terminating in a divergent leading edge cavity aft of an inner surface of the leading edge; and

wherein the plurality of impingement channels vary in length such that a first impingement channel located closest to the first end of the generally elongated hollow airfoil is shorter than an impingement channel located immediately adjacent the first impingement channel, and each impingement channel is longer than an impingement channel positioned immediately adjacent and closer to the first end of the generally elongated hollow airfoil.

14. The turbine vane of claim 13, wherein the plurality of impingement channels each terminate at a substantially equal distance from an inner surface of the leading edge of the generally elongated hollow airfoil.

15. The turbine vane of claim 13, wherein at least a portion of the plurality of impingement channels have different cross-sectional areas.

16. The turbine vane of claim 13, wherein each of the plurality of impingement channels have substantially equal cross-sectional areas.

17. The turbine vane of claim 13, wherein distances between adjacent impingement channels vary.

18. The turbine vane of claim 13, further comprising a plurality of pin fins coupled to at least one of the impingement channels and positioning the impingement channel inside the generally elongated hollow airfoil.

19. The turbine vane of claim 18, wherein each of the plurality of impingement channels has at least one pin fin extending between an inner surface of the suction side and attaching to an impingement channel and has at least one pin fin extending between an inner surface of the pressure side and attaching to the impingement channel.

20. The turbine vane of claim 13, further comprising a plurality of trip strips in the serpentine cooling pathway.